

REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Supporting evidence

Applicants enclose herewith in support a Declaration under 37 CFR § 1.132 by Alessandro Galbiati, one of the co-inventors of the instant application, as well as of the cited prior art Galbiati patent. Applicants also attach Annexes 1 and 2, showing reactions examples from the instant application (designated as "Galbiati 2") and the cited Galbiati patent (designated as "Galbiati 1"), which will be explained in more detail below.

Claim objections and new claim

Applicants have amended the claims as requested by the Examiner. In claim 2, the definition of R" was moved to the end of the claim. Process claim 12 was cancelled and new process claim 16 is substituted, employing positive steps for the preparation of the silane terminated polymer as described in claim 1. No new matter has been added.

Rejection under 35 USC § 112, second paragraph

Applicants have amended the claims to more clearly claim the subject invention. Claim 2 has been amended to delete the reference to "heterohydrocarbon" and "amino hydrocarbon." Claim 7 has been amended to delete the term "preferably" and to replace "or R⁸" with "and R⁸." Claims 8, 10, and 11 have been amended to delete the preferred and more preferred ranges.

Rejection under 35 USC § 102

Claims 1-9 stand rejected under 35 USC § 102 as being anticipated by Galbiati et al. U.S. Patent No. 6,221,994. Applicants respectfully traverse this rejection.

Applicants' invention as defined by claim 1 is directed to a silane terminated polymer obtained by addition reaction between an organic derivative of silicon and the terminal functional groups of linear or branched polymers obtained by the Michael polyaddition reaction of sulphhydric acid (H_2S) with organic compounds which have at least two alkenyl double bonds activated by the presence, in the alpha position with respect to each alkylene bond, of an electronegative group.

Applicants are thoroughly familiar with their own prior art cited by the Examiner, and have endeavored to distinguish it throughout the instant application. Applicants' process for making the claimed product is clearly different from the cited Galbiati patent since the reactant used in the Michael polyaddition disclosed by Galbiati is an organic compound, namely a dithiol of formula $HS-R'SH$, wherein R' is a divalent alkyl radical of form 1 to 12 carbon atoms. By contrast, an inorganic compound H_2S used in the Michael polyaddition of the present invention. However, more importantly, applicants' product as presently claimed in claim 1 is in fact different from that made by the cited Galbiati patent, as will be explained in more detail below.

In the Galbiati patent, the intermediate product (which will be utilized in the reaction with the silyl compound to obtain the final silane terminated polymer) may be obtained by reacting the di(meth)acrylate of formula (12) column 6, line 5, where R^1 is H or CH_3 , $R^2 = OR^3$, wherein R^3 is a divalent alkyl radical of from 2 to 4 carbon atoms with the 1,2-ethanedithiol (column 7 line 1), thereby obtaining :

- the product obtained in reaction scheme (13) (Galbiati column 8, line 1) in the case where $n+1$ moles of the di(meth)acrylate are reacted with n moles of the 1,2-ethane dithiolo, and
- or the product obtained in scheme (14) (Galbiati column 8, line 2) when $n+1$ moles of 1,2 dithiolane is used with n moles of di(meth)acrylate.

In the enclosed Annex 1 and Annex 2, there is shown the two specific examples of the above said reaction, thereby bringing to:

- the compound (2) which may be rewritten with the formula (2') coinciding with the formula of the product obtained in reaction scheme (13) having $n = 2$, $R' = -CH_2-CH_2-$ and $R2 = -CH_2-CH_2$, and
- the compound of formula (4) which may be rewritten with the formula (4') similar to the compound of formula (14) having $n = 2$, $R' = -CH_2-CH_2-$ and $R2 = -CH_2-CH_2$.

In the present invention, the intermediate product (which will be utilized in the reaction with the silane compound to obtain the final silane terminated polymer) may be prepared with a Michael polyaddition reaction between the diacrylate of formula (11) reported at page 15 of the instant application wherein R^7 has the same meanings as R^1 and when R^{10} is $-CH_2CH_2-$ and $n' = 1$, which coincides with the di(meth)acrylate of formula (12) of the Galbiati patent thereby resulting in the following products:

- the product obtained in reaction scheme (17) when an excess ($n+1$ moles) of the diacrylate is used with respect to n moles of the 1,2-ethane dithiolo, and
- the product obtained in the reaction scheme (18) when an excess ($n+1$ moles) of H_2S with respect to the diacrylate (n moles).

In the enclosed Annexes 1 and 2, there is shown the two specific examples of the above reactions carried out according to the present invention, wherein the diacrylate of formula (11) has $R^7 = H$, $R^{10} = CH_2CH_2$, $n' = 1$, and therefore using the same diacrylate utilised by the Galbiati patent for the analogous reactions reported in the same Annexes 1 and 2.

In fact in Annexes 1 and 2 the Michael reaction of the present invention (designated as "Galbiati 2") bring to the following products:

- the compound (1) which may be rewritten with the formula (1') coinciding with the formula of the product obtained in reaction scheme (17) on page 18 of the instant application having $n = 2$, and R^{10} , R^7 and n' having the aforementioned meanings, and
- the compound (3) which may be rewritten with the formula (3') coinciding with the formula of the product obtained in reaction scheme (18) of the instant application having $n=2$, and R^{10} , R^7 and n' having the aforementioned meanings.

If one compares the compound of formula (1) or (1') of Annex 1 prepared according to the present invention (Galbiati 2) with the corresponding compound of formula (2) or (2') prepared according to the Galbiati patent (Galbiati 1), it is clear that they are not identical, but they differ as the former does not contain the repeating unit $-(CH_2CH_2)S$. See, the phantom outline portions of the molecule (2) or (2').

Analogously, the compound of formula (3) or (3') of Annex 2 prepared according to the present invention is not identical with the compound of formula (4) or (4') prepared according to the Galbiati patent since also in this case the latter contains the

repeating units -(CH₂CH₂)S. See, the phantom outline portion of (4) or (4') absent in the molecule of formula (3) and (3') prepared according to the present invention.

It therefore follows that the final silane terminated polymer as claimed in claim 1 of the instant application is a different product having different properties than, and is thus novel over, the silane terminated polymers of the cited Galbiati patent.

In addition this product-by-process of claim 1 can in no way be considered equivalent or obvious in view of the product taught in the Galbiati patent since the silane terminated polymer of the present invention no longer contains inside the molecular chain the repeating unit deriving from the organic dithiol joining two repeating units deriving from two molecules of a di(meth)acrylate, but on the contrary it only contains inside the polymeric chain the sulphur atoms joining two repeating units deriving from 2 molecules of di(meth)acrylate. See, Annex 2, formulas 3' (instant invention) and 4' (Galbiati patent). The polymer of the instant invention is unobviously different than that of the Galbiati patent for additional reasons:

First, this brings in the claimed polymer of the present invention a great decrease in the molecular weight of the repeating unit as well as a decrease in the number of S atoms per unit weight, with these two parameters greatly influencing the physical-chemical properties of the polymer.

Second, another major modification present in the polymers of the present application compared to the polymers of Galbiati is the fact that the electron-attractive groups in beta position relative to the S atom are much closer one to the other. In fact, while in the polymers of Galbiati the electron-attractive groups are spaced by two S atoms and an alkylene chain in the polymers of the present invention these two groups are separated only by a S atom.

This results in a stiffening of the macromolecular chains of the polymer of the invention that are less prone to move, as well as a change in the intermolecular forces between the molecules of polymer, which changes that may influence both the viscosity of the polymer and its ability to cross-link.

Applicants have herein met their burden to prove that "the prior art products do not necessarily or inherently possess the characteristics of [the applicant's] claimed product" *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433. See also, *In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596. In view of the foregoing, the holding of *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Circ 1985) cannot apply to the product-by-process as claimed in claim 1, since it is different and not obvious from Galbiati. Thus, applicants submit that the invention of claim 1-9 is not anticipated by the Galbiati patent under 35 USC § 102.

Rejection under 35 USC § 103

Claims 1-9 and 11-14 stand rejected under 35 USC § 103 as being obvious from Galbiati in view of Quis U.S. Patent No. 4,340,707. Claims 14 and 15 stand rejected under 35 USC § 103 as being obvious from Galbiati in view of Quis, and further in view of Sullivan U.S. Patent No. 4,231,956. Claim 10 stands rejected under 35 USC § 103 as being obvious from Galbiati in view of Quis, and further in view of Erickson U.S. Patent No. 3,397,189. Applicants respectfully traverse these rejections.

Composition claims 1-11

The Examiner admits that the Galbiati patent is silent about the use of sulphhydric acid, but then contends Quis teaches a method of preparing a Michael polyaddition polymer utilizing hydrogen sulphide. The Examiner takes the position that the use of same would be obvious to one of ordinary skill in the art on the grounds that

motivation of using hydrogen sulphide is that hydrogen sulphide can produce a reaction product free of odour. Office Action, p.6.

As discussed above, the terminated silane polymers according to the present invention are novel and also they are not equivalent, structurally speaking, to the silane terminated polymers disclosed by Galbiati, as the former do not contain a dithiol repeating unit inside the polymeric chain, but only a S atoms joining two repeating units deriving from two molecules of diacrylate or dimethacrylate. This results in a significant decrease in the molecular weight of the repeating unit as well as a decrease in the number of S atoms per unit weight, with the result that these two parameters greatly influencing the physical-chemical properties of the polymer.

Another major modification present in the polymers of the present application compared to the polymers of Galbiati is the fact that the electron-attractive groups in beta position relative to the S atom are much closer one to the other. In fact, while in the polymers of Galbiati the electron-attractive groups are spaced by two S atoms and an alkylene chain, in the polymers of the present invention these two groups are separated only by a S atom.

This results in stiffening of the macromolecular chains of the polymer, that are less prone to move, as well as in the change in the intermolecular forces between the molecules of polymer, changes that influence both the viscosity of the polymer and its ability to cross-link.

Therefore, it is surprising and unexpected that the polymers of the present invention have a viscosity (compare Example 1 with comparative Example A) or an ability to cross link equivalent to those of the polymers of the Galbiati patent.

The aforementioned surprising and unexpected results could in no way be foreseeable from the Quis patent, since Quis only deals with polymers obtained by Michael polyaddition reaction and not silane terminated polymers like those of the present invention.

In addition, submitted herewith in the form of a Declaration under 37 CFR § 1.132 by Alessandro Galbiati are further experimental tests demonstrating that the polymers of the invention after crosslinking are more stable to oxidation than taught in the Galbiati patent.

In particular, the applicants have found that the polymers disclosed by the Galbiati patent have the inconvenience that the solid products obtained therefrom show a high sensitivity to oxidation by atmospheric oxygen, which is increased by UV light and high temperatures. In order to solve this problem, antioxidants and/or UV stabilizers are usually added to the polymers taught by the Galbiati patent before inducing cross-linking. However, notwithstanding the addition of these compounds, the solid product after a certain period of time is modified by oxidation and shows cracks on its surface.

By contrast, as shown in the enclose declaration, films of the compound of the present invention under the same condition do not show any visible sign of degradation.

The above advantageous property of the compounds of the present invention is decidedly unexpected both from Galbiati even if combined with any teaching by Quis. Quis refers only to odor reduction of hydrogen sulfide in intermediate polymers and would not teach odor reduction in silane terminated polymers, as in the present invention. Accordingly, the silane terminated polymer as claimed in claim 1 is not

obvious to one of ordinary skill in the art from a hypothetical combination of Galbiati in view of Quis. Erickson, cited by the Examiner in connection with claim 10, does not overcome the deficiencies of Quis, as discussed above.

Process claims 13-16

The process for preparing the silane terminated polymer as recited in claims 13-16 is further not obvious from the cited prior art. In the portion of Quis cited by the Examiner, the Michael polyaddition reaction is carried out by using the polythiol compound (pentaerythritol-tetrakis -mercapto acetic acid ester) and not H₂S. In fact, Quis' examples of polyaddition reaction with H₂S involve the use of an inorganic base like sodium hydroxide as the catalyst. Thus, applicants' process of new claim 16 is not obvious from a combination of Galbiati and Quis.

Furthermore, dependent process claims 14 and 15 are not obvious form Galbiati in view of Quis and in further view of Sullivan since the latter does not overcome the deficiencies of Quis, as discussed above.

It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,

Peter W. Peterson
Reg. No. 31,867

DeLIO & PETERSON, LLC
121 Whitney Avenue
New Haven, CT 06510-1241
(203) 787-0595